DOCUMENT RESUME

ED 092 356 SE 017 611

AUTHOR	Weiss, Alan; And Others
TITLE	Digestion, Excretion and Metabolism, Science (Experimental): 5346.03.
INSTITUTION	Dade County Public Schools, Miami, Fla.
PUB DATE	72
NOTE	15p.; An Authorized Course of Instruction for the Quinmester Program
EDRS PRICE	MF-$0.75 HC-$1.50 PLUS POSTAGE
DESCRIPTORS	Behavioral Objectives; Biology; *Human Body; Instruction; *Instructional Materials; Science Education; *Secondary School Science; *Teaching Guides; Units of Study (Subject Fields)
IDENTIFIERS	*Quinmester Program

ABSTRACT

This unit of instruction deals with a study of human physiology with emphasis on the process of digestion. The urinary system and urinary disorders are also discussed. The course is for the interested student and requires credit or background in previous biology programs. It is, in part, a second course in biology, but it is well within the range of the average student. The booklet lists the relevant state-adopted texts and states the performance objectives for the unit. A course outline is presented as well as suggested laboratory experiments, projects, reports, field trips, and guest speakers. Visual aids relevant to the unit are listed to include films, film loops, slides, film strips, and transparencies. Reference books are recommended, and a master sheet is provided relating each suggested activity to the specific performance objectives. (EB)

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AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

DIGESTION, EXCRETION AND METABOLISM

5346.03
5363.03

SCIENCE

(Experimental)

DADE COUNTY PUBLIC SCHOOLS

DIVISION OF INSTRUCTION • 1971

DIGESTION, EXCRETION AND METABOLISM

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Written by Alan Weiss,
Richard Petty,
and Peter Saponaro
for the
DIVISION OF INSTRUCTION
Dade County Public Schools
Miami, Florida
1972

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COURSE DESCRIPTION

This course will include an intensive in-depth study of the process of digestion, the anatomy of the digestive systems, enzymes, metabolism and digestive disorders. It will also cover the urinary systems and urinary disorders.

ENROLLMENT GUIDELINES

This is a course for the interested student and should follow credit or background in previous biology programs. It is, in part a second course in biology, but it is well within the range of the average student.

STATE ADOPTED TEXTS

1. Morrison, Thomas F.; Cornett, Frederick D.; Tether J. Edward, and Gratz, Pauline. Human Physiology. New York: Holt, Rinehart and Winston, Inc., 1967.

2. Kimber, Diana et. al.. Anatomy and Physiology. New York: The Macmillan Co., 1966.

PERFORMANCE OBJECTIVES

1. Evaluate the six nutrients in terms of their energy and protoplasmic contributions during metabolism.

2. Analyze enzyme action in terms of enzyme concentration, substrate concentration, coenzymes, temperature and pH.

3. Describe the role of vitamins as they relate to various dietary deficiencies.

4. Examine the structures of the mouth — tongue, teeth, salivary glands - as to their role in initiating digestion.

5. Describe the "feedback" mechanism that regulates gastric secretions.

6. Analyze the role of the liver with regard to the digestive system with emphases on bile, glycogen, and urea formation.

7. Integrate the role of each digestive process with emphases on origin of enzyme, substrate acted upon, and final end products.

8. Relate the anatomical adaptations of the different regions of the alimentary canal to their role in the absorption of different nutrients.

9. Distinguish among the various layers of the alimentary canal as to their role in peristalsis.

10. On a practical examination of the cat, identify the major structures of the mouth, pharynx, stomach, small intestine, large intestine and the associated digestive glands.

11. Discuss critically the various digestive disorders such as diarrhea, ulcers, colitis, illeitus, intestinal colic, choleostasis.

12. Integrate the processes of filtration, reabsorption, and active transport as they occur in the nephron.

13. Describe the various disorders associated with the excretory system, glomerulonephritis, tubular nephritis, uremia, acidosis, alkalosis, dehydration, urethritis, polyuria, diuresis, oliguria.

14. On a practical examination identify the major structures of a sheep kidney, and the kidney, ureter, bladder, and urethra of a cat.

15. Identify the variables affecting basic metabolic rate and the methods used in measuring the metabolic rates.

16. Compare selected foods in terms of their metabolic activity within the body.

17. Investigate the following metabolic disorders: diabetes mellitus, gluconeogenesis, phenylketonuria, hyperglycemia, hypoglycemia, ketosis, acidosis, hyperthyroidism, hypothyroidism.

COURSE OUTLINE

I. Foods and Nutrition

- A. Carbohydrates, lipids, and proteins
- B. Water and mineral salts
- C. The diet

II. Enzymes and Vitamins

- A. Enzyme action
- B. Effects of temperature, pH, and end products
- C. Oil and water soluble vitamins
- D. Diseases resulting from vitamin and dietary deficiencies

III. Mouth and Esophagus

- A. Structure of the tongue and teeth
- B. Mastication
- C. Digestive action of saliva
- D. Deglutition

IV. Stomach

- A. Anatomy
- B. Action of gastric secretions
- C. Phases of stomach secretion and stomach movements
- D. Stomach disorders - vomiting and emotional stress

V. The Intestines

- A. Liver and bile formation
  - 1. Composition of bile
  - 2. Action of bile
- B. Glycogen and urea formation
- C. Pancreatic structure and enzymes
- D. Intestinal enzymes and movements
- E. Nutrient absorption
- F. Colon structure
  - 1. Water absorption
  - 2. Bacterial action
  - 3. Formation of feces and colon movements
- G. Digestive disorders

VI. The Kidneys

- A. Structure and function

B. The nephron
   1. Filtration
   2. Formation of organic excretory products
C. Kidney action and influencing factors
D. Urination
E. Disorders of the excretory system

VII. Metabolism

A. Energy values of foods
B. Basal metabolic rate and factors affecting metabolic rate
C. Protein bound iodine test
D. Metabolic disorders

EXPERIMENTS

Chaffee, Ellen. Laboratory Manual in Physiology and Anatomy. Philadelphia: Lippincott, 1969.

1. The Digestive System (Exp. 20, p. 198)
2. Absorption and Metabolism (Exp. 21, p. 203)
3. The Urinary System (Exp. 22, p. 217)

Anthony, Catherine Parker. Anatomy and Physiology Laboratory Manual. St. Louis: C. V. Mosby Company, 1967.

4. Digestive Organs of Anesthetized Animals (Exp. A, p. 191)
5. Deglutition (Exp. B, p. 197)
6. Digestion of Carbohydrates by Saliva (Exp. C, p. 199)
7. Anatomy of the Urinary System (Exp. A, B, p. 201)
8. Physiology of the Kidney (Exp. C, p. 207)

Leavell, Lutie; Chapin, Florence, and Miller, Marjorie. Workbook and Laboratory Manual in Anatomy and Physiology. New York: Macmillan Co., 1964.

9. The Digestive Organs (Exp. A, B, p. 151)
10. The Portal System (Exp. C, p. 160)
11. Role of Minerals and Vitamins in the Body (Exp. D, E, p. 164)
12. End Products of Digestion (Exp. F, p. 166)
13. Chemical Digestion (Exp. G, p. 167)
14. Absorption and Secretion (Exp. H, p. 168)
15. Visceral Arteries and Veins (Exp. I, p. 169)
16. Kidney Structure and Function (Exp. A, B, p. 171)
17. The Nephron (Exp. C, p. 174)
18. The Role of Hormones in Kidney Function (Exp. D, p. 174)
19. Glomerular and Tubal Function in the Kidney (Exp. E, p. 175)

Tuttle, W. W., Schottelius, Byron. Physiology Laboratory Manual. St. Louis: C. V. Mosby Company, 1963.

20. Deglutition and Salivary Functions (Exp. 49, 50, p. 152)

21. Urine — Composition and Character (Exp. 51, p. 156)
22. Basal Metabolic Rate (Exp. 38, p. 118)
23. Specific Dynamic Action of Foodstuffs (Exp. 39, p. 121)

Jones, Claiborne, Lehman, Lillian. Laboratory Guide in Introductory Vertebrate Zoology. Chapel Hill: Department of Zoology, University of North Carolina, 1969.

24. Visceral Organs of the Dogfish Shark (Exp. III, p. 40)
25. Digestive System of a Frog (Exp. III, p. 46)
26. Urogenital System of a Frog (Exp. III, p. 48)

Elliott, A. M. Laboratory Guide for Zoology. Minneapolis: Burgess Publishing Co., 1957.

27. Digestive System of the Frog (Exp. IV, p. 154)
28. Urogenital System of the Frog (Exp. IV, p. 161)
29. Digestive System of the Fetal Pig (Exp. V, p. 193)
30. Urogenital System of the Fetal Pig (Exp. V, p. 195)

Biological Sciences Curriculum Study. Biological Science: Molecules to Man. Boston: Houghton Mifflin Company, 1963.

31. Catalytic Activity of Enzymes in Living Materials (Exp. 15, p. L32)
32. Effects of Various Factors on Enzyme Activity (Exp. 16, p. L33)
33. Digestion of Fat (Exp. 48, p. L99)
34. Detection of Organic Nutrients (Exp. 49, p. L100)
35. The Kidney Tubule (Exp. 50, p. L101)

Booth, Ernest S., and Chiasson, Robert B. Laboratory Anatomy of the Cat. Dubuque: Wm. C. Brown and Company, 1970.

36. The Digestive System of the Cat (Chap. 4, p. 31)
37. The Urinary System of the Cat (Chap. 7, p. 47)

Morrison, Thomas F.; Cornett, Frederick D.; Tether, J. Edward, and Gratz, Pauline. Experiments in Physiology. New York: Holt, Rinehart and Winston Inc., 1967.

38. Water in Foods (Exp. 39, p. 33)
39. Inorganic Elements in Foods (Exp. 40, p. 33)
40. Detecting Monosaccharides (Exp. 41, p. 33)
41. Carbon in Carbohydrates (Exp. 42, p. 24)
42. Detecting a Polysaccharide, Starch (Exp. 43, p. 34)
43. Detecting Lipids (Exp. 44, p. 34)
44. Detecting Proteins (Exp. 45, p. 35)
45. Enzymes (Exp. 46, p. 36)
46. Vitamins (Exp. 47, p. 36)
47. Taste and Smell (Exp. 48, p. 37)
48. Salivary Digestion (Exp. 49, p. 38)
49. Study of the Teeth (Exp. 50, p. 38)
50. The Process of Swallowing (Exp. 51, p. 39)

51. Gastric Digestion (Exp. 52, p. 39)
52. Intestinal Digestion (Exp. 53, p. 40)
53. Metabolic Rate Calculations (Exp. 77, p. 59)
54. Caloric Values of Foods (Exp. 78, p. 62)
55. The Structure of the Mammalian Kidney (Exp. 79, p. 63)
56. The Composition of Urine (Exp. 80, p. 63)

PROJECTS

1. Construct a bomb calorimeter.

2. Design an experiment to study long range dietary deficiencies on experimental animals.

3. Construct a plastic-mount kidney illustrating the circulatory pattern. Use triple injected kidney.

REPORTS

1. Comparison of various types of weight loss diets.

2. Selected reports on diseases and/or disorders of the digestive system.

3. Selected reports on diseases and/or disorders of the excretory system.

FIELD TRIPS

1. Miami Kidney Institute.

SPEAKERS

1. Urologist

2. Operator of Hemodialysis Unit

3. Artificial Kidney Patient

FILMS AVAILABLE FROM DADE COUNTY AUDIOVISUAL CENTER

1. Human Body: The Nutrition and Metabolism
AV#1-11244, 14' C

2. Obesity
AV#1-03440, 12' BW

3. Understanding Vitamins
AV#1-11287, 14' C

4. Teeth: Their Structure and Care
AV#1-03505, 10' C

5. Digestion: Chemical
AV#1-11235, 18' BW

6. Digestion of Foods
AV#1-03115, 10' BW

7. The Alimentary Tract
AV#1-03113, 11' BW

8. Energy and Work
AV#1-01719, 11' C

9. Patterns of Energy Transfer (A.I.B.S., Pt. 1, No. 6)
AV#1-30537, 30' C

10. The Human Body—Excretory System
AV#1-11214, 13½' C

11. Excretion (A.I.B.S., Pt. 4, No. 6)
AV#1-30444, 28' C

12. Work of the Kidneys
AV#1-03449, 11' BW

13. Digestion of Foods
AV#1-03115, 10' BW

14. Foods and Nutrition
AV#1-03128, 11' BW

15. Human Body - The Digestive System
AV#1-11240, 13' C

16. Ingestion and Digestion (A.I.B.S. Pt. 4, No. 3)
AV#1-30439, 28' C

17. Oral Hygiene
AV#1-30733, 30' BW

FILM LOOPS

ENCYCLOPAEDIA BRITANNICA EDUCATIONAL CORPORATION CATALOG

1. Human Skin, 80716
2. Swallowing, 80716
3. The Kidney, 80715
4. What is a Tooth?, 80698
5. The Nature of Decay, 80701

SLIDES, 2" x 2"

WARDS CATALOG

1. The Gastrointestinal System, 170W 8100, 13 slides
2. The Hepatobilliary System, 170W 8150, 17 slides
3. The Urinary System, 170W 8300, 14 slides

FILM STRIPS

EYE GATE HOUSE INC.

1. Digestive Systems, 2-1-B
2. Excretory Systems, 2-1-F

TRANSPARENCIES

DADE COUNTY AUDIOVISUAL CENTER

1. Digestive System - Man (No. 1) 2-00060
2. Digestive System - Man (No. 2) 2-00072
3. Excretory System - Man, 2-00064
4. Human Digestive System, 2-00042
5. Human Mouth and Nasal Cavities, 2-00035
6. Human Teeth, 2-00040
7. Structure of a Tooth, 2-00146

REFERENCES

1. Booth, Ernest S. and Chiasson, Robert B. Laboratory Anatomy of the Cat. Dubuque, Iowa: Wm. C. Brown Co., 1970.

2. Carlson, Anton; Johnson, Victor; Cavert, H. Mead. Machinery of the Body. Chicago, Illinois: University of Chicago Press, 1961.

3. Chaffee, Ellen, and Greisheimer, Esther. Basic Physiology and Anatomy. Philadelphia: J. B. Lippincott Co., 1969.

4. Crouch, James. Functional Human Anatomy. Philadelphia: Lea and Febiger, 1970.

5. DeRobertis, E. D. P.; Nowinski, Wiktor W., and Saez, Francisco A. Cell Biology. Philadelphia: W. B. Saunders Co., 1968.

6. Frohse, Franz; Brodel, Max; and Schlossberg, Leon. Atlas of Human Anatomy. New York: Barnes and Nobel, 1961.

7. Canong, William F. Review of Medical Physiology. Los Altos, California: Lange Medical Publications, 1965.

8. Guyton, Arthur. Function of the Human Body. Philadelphia: W. B. Saunders Co., 1969.

9. Jacob, Stanley and Francone, Clarice. Structure and Function in Man. Philadelphia: W. B. Saunders Co., 1965.

10. Torrey, Theodore W. Morphogenesis of the Vertebrates. New York: John Wiley and Sons Co., 1967.

MASTER SHEET--DIGESTION, EXCRETION, METABOLISM

Objectives	Texts	Lab Exp. and/or Demonstrations	Films	Film Loops	Film Strips	Trans. parencies	2" x 2" Slides	Supplementary References
1	#1. pp. 183-20	2,17,22,23,38, 39,40,41,42,43, 49,54	1,4,13,14					#3. pp. 453-459 #8. pp. 385-394 #7. pp. 378-385 #2. pp. 357-399
2	#1. pp. 200-217	2,31,32,45	3,5,6,9,15,16		1			#9. pp. 391, 388-396 #8. pp. 15-16 #5. pp. 41-53
3	#1. pp. 200-217	2,11,46	3					#3. pp. 455-459 #9. pp. 404-405 #8. pp. 309-393 #7. pp. 245-247 #2. pp. 392-399
4	#1. pp. 218-229	1,2,4,5,6, 20,57,48,49, 50	4,6,7,13,15, 17	4,5	1	5,6,7		#2. pp. 361-371 #3. pp. 460-466 #9. pp. 381-384 #8. pp. 357-358 #7. pp. 386-388 #2. pp. 315-316
5	#1. pp. 229-237	1,2,4,9,51						#4. pp. 380-385 #3. pp. 485-487 #9. p. 394 #8. pp. 365-366 #7. pp. 388-395 #2. pp. 324-326
6	#1. pp. 239-244	1,2,4,9,13, 14,33,34,52			1		2	#4. pp. 392-400 #3. pp. 474-481 #9. pp. 400-403 #8. pp. 374-380 #7. pp. 400-403 #2. pp. 328, 385-360, 580-588
7	#1. pp. 183-256	1,2,4,9,13, 14,33,34,52	5,6,7,13,15,16		1			#4. pp. 357-404 #3. pp. 453-519 #9. pp. 374-416 #8. pp. 355-396 #7. pp. 378-408 #2. pp. 306-404 #10. pp. 234-261
8	#1. pp. 183-256	1,2,4,9	7		1	1,3,4	1	#4. pp. 357-360, 371-392 #3. pp. 456-483 #9. pp. 397-399 #8. pp. 369-384 #7. pp. 386-406 #2. pp. 306-312 #6. pp. 89-97 #10. pp. 234-261
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11	#1. pp. 218-256	1,2,4,9						#4. pp. 384-400 #3. pp. 453-493 #8. pp. 357-370 #7. pp. 378-407 #2. pp. 352-355 #6. p. 98
12	#1. pp. 387-396	3,7,8,16,17, 18, 19,21,35, 36	10,11,12	3	2	3	3	#4. pp. 431-437 #3. pp. 521-528 #9. pp. 420-427 #8. pp. 195-206 #7. pp. 548-550 #2. pp. 409-422 #6. pp. 99-101
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